

Biodiesel Assessment Regarding Potential Application to SBMTD Bus Fleet

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SOURCE DOCUMENTS

The following documents were used during preparation of this report:

1. "Biodiesel Handling and Use Guidelines", DOE/GO-102006-2358, Third Edition, September 2006, US Dept. of Energy, Energy Efficiency and Renewable Energy.
2. "Technical Recommendations for B20 Fleet Use Based on Existing Data", B20 Fleet Evaluation Team, June 2005
3. "What is Cummins' Position on the Use of Biodiesel Fuel in Cummins Engines?", <http://www.cummins.com/cmi/content.jsp?siteId=1&langId=1033&menuId=6&overviewId=29&anchorId=44&menuIndex=4&index=3#Q6>
4. "Engine Requirements – Lubricating Oil, Fuel and Filters", Section 5.1.4 Biodiesel Fuels, Detroit Diesel Corporation, Rev. 10/05
5. "Standards and Warranties", National Biodiesel Board, http://www.biodiesel.org/resources/fuelfactsheets/standards_and_warranties.shtm

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1. EXECUTIVE SUMMARY

The Santa Barbara Metropolitan Transit District (MTD) has been a national leader in the application of alternative fuels to the public transportation industry and is now exploring the potential of biodiesel as a transit bus fuel. Biodiesel is a renewable fuel manufactured from vegetable oils, animal fats, and recycled cooking oils, and is most commonly used in the US as a blend of 20% biodiesel and 80% petrodiesel (referred to as B20). B20 can be used in most equipment designed to use diesel fuel, while higher blends require special handling, fuel management, and possible equipment modifications, and are generally not recommended for the first-time biodiesel user.

A number of benefits accrue from the use of biodiesel, including reduced dependence on imported oil, reductions in particulate matter, hydrocarbon, carbon monoxide, and greenhouse gas emissions, and improved lubricity. Disadvantages include reduced energy content (resulting in reduced power and fuel economy of approximately 1.2% for B20 as compared with petrodiesel), and the potential for slight increases in nitrogen oxide emissions, although this issue is the subject of current debate and additional research. Although it is difficult to make generalized statements regarding comparative pricing between biodiesel and petrodiesel given recent price volatility in the petroleum market, B5 is presently available at about the same price as petrodiesel while B20 sells at a premium of about five cents per gallon.

Engine manufacturers specifically allow the use of biodiesel in blends of up to 5% (B5). Use of higher blends do not automatically void their product warranties (which cover materials and workmanship), but if engine or fuel system problems occur and can be traced to the use of biodiesel blends greater than B5, such problems will not be covered under warranty. Biodiesel has been used successfully by out-of-state public transit agencies in blends as high as B75. There is current speculation that engine manufacturers will approve the use of blends of up to B20 upon release of a B20 specification, expected from ASTM in mid-2007.

Although the California regulatory position regarding biodiesel is in transition and subject to conflicting interpretations, Air Resources Board indicates that blends of up to B20 are permitted for use in state transit bus fleets. Nevertheless, a brief survey of the industry failed to identify any California transit agencies that are using biodiesel. Consequently, there appears to be an opportunity for MTD to continue its environmental leadership role (and enjoy the marketing benefits that accrue) by being the first, or one of the first, transit agencies in California to begin using biodiesel; in such an event, the use of B5 would appear to introduce few, if any, concerns.

Because the technologies, standards, and regulations relating to this industry are evolving rapidly as interest in (and use of) biodiesel fuel increases, it is recommended that the findings and conclusions of this assessment be periodically revisited until such time that the industry matures and conditions stabilize.

2. BACKGROUND

The Santa Barbara Metropolitan Transit District (MTD) has been a national leader in the application of alternative fuels to the public transportation industry. MTD's pioneering work with electric buses is acknowledged and respected worldwide. Continuing in this vein, MTD is now considering the use of biofuels (specifically biodiesel) in its fleet as a means to address the energy security, sustainability, and environmental issues associated with the utilization of petroleum fuels. MTD has therefore commissioned this study of the current status of biodiesel and its potential applicability to its transit bus fleet.

The objectives of this assessment are to:

- Identify the benefits associated with the use of biodiesel and biodiesel blends;
- Determine its influence on engine function, maintenance, and warranties;
- Ascertain current regulations affecting the use of biodiesel in transit bus fleets; and
- Determine the availability and cost of the various biodiesel blends.

It is beyond the scope of this document to fully describe all considerations relevant to the use of biodiesel in transit bus fleets. Furthermore, the related technologies, standards, and regulations are evolving rapidly as interest in (and use of) biodiesel fuel increases. It is therefore recommended that the findings and conclusions of this assessment be periodically revisited until such time that the industry matures and conditions stabilize.

3. INTRODUCTION

Biodiesel is a renewable fuel manufactured from vegetable oils, animal fats, and recycled cooking oils. Although biodiesel is sometimes used in pure form (also referred to as "neat" form or B100) it is more commonly blended with petrodiesel. B20 (a blend of 20% biodiesel and 80% petrodiesel) is the most common biodiesel blend in the US because it represents a good balance between differences in fuel properties, performance, emission benefits, and costs, and because it is the minimum blend level that qualifies for Energy Policy Act of 1992 (EPAct) credits.¹ B20 can be used in most equipment designed to use diesel fuel, including compression-ignition engines, fuel oil and heating oil boilers, and turbines. Higher blend levels (such as B50 or B100) require special handling and fuel management and may require equipment modifications, and are generally not recommended for the first-time biodiesel user.

The biodiesel manufacturing process converts oils and fats into chemicals called "long-chain mono alkyl esters", "fatty acid methyl esters" ("FAME"), or "biodiesel". In the manufacturing process, 100 pounds of oils or fats are reacted with 10 pounds of a short chain alcohol (usually methanol) in the presence of a catalyst (usually sodium or

¹ The Energy Policy Act of 1992 mandates the use of alternative fuels in federal, state, and alternative fuel provider fleets; the 2004 Final Rule exempted private and local government (e.g., public transit) fleets from regulation.

potassium hydroxide) to form 100 pounds of biodiesel and 10 pounds of glycerin (a sugar). Raw or refined vegetable oil, or recycled greases that have not been processed into biodiesel, are not biodiesel and should be avoided (the higher viscosity of such products can cause long-term engine deposits, ring sticking, lube oil gelling, and reduced engine life). Any biodiesel used in the United States for blending should meet ASTM D6751 standards.

4. BENEFITS OF BIODIESEL USE

4.1 Increased National Energy Security

Pure biodiesel yields 3.2 units of fuel energy for every unit of fossil energy used to produce the fuel² (including the energy used in diesel farm equipment and transportation equipment, fossil fuels used to produce fertilizers and pesticides, fossil fuels used to produce steam and electricity, and methanol used in the manufacturing process), thereby reducing our nation's reliance on imported petroleum.

4.2 Reduced PM, HC, and CO Emissions

Biodiesel reduces tailpipe particulate matter (PM), hydrocarbon (HC), and carbon monoxide (CO) emissions from most modern four-stroke compression-ignition engines (Figure 1)³. These benefits occur because biodiesel contains oxygen (B100 contains 11% oxygen by weight) which allows the fuel to burn more completely, resulting in fewer unburned emissions. Testing has shown that emissions reductions are independent of the feedstock used to make biodiesel.

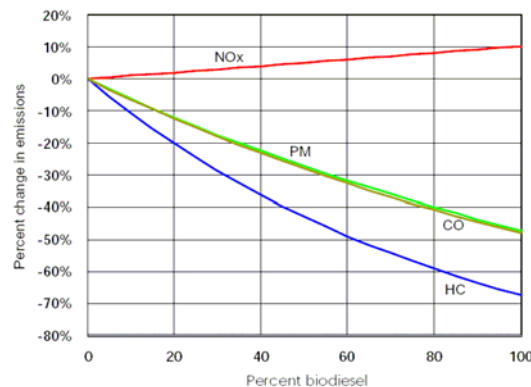


Figure 1. Average Emissions Impacts of Biodiesel for Heavy-Duty Highway Engines

4.3 Reduced Greenhouse Gas Emissions

The use of biodiesel has also been shown to result in reduced greenhouse gas (GHG) emissions when compared with petrodiesel. Comparative GHG emissions (weighted by 100-year global warming potential) for a number of fuels when used in the urban bus application are presented in Figure 2.⁴

² Sheehan et al. May 1998. *A Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus*. NREL/SR-580-24089.

³ Environmental Protection Agency. October 2002 Draft Technical Report, *A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions*, (EPA420-P-02-001) (<http://www.epa.gov/oms/models/analysis/biodsl/p02001.pdf>)

⁴ P. Griffith. *Fuel Options for Mobile and Stationary Applications at Santa Barbara MTD*. September 27, 2006.

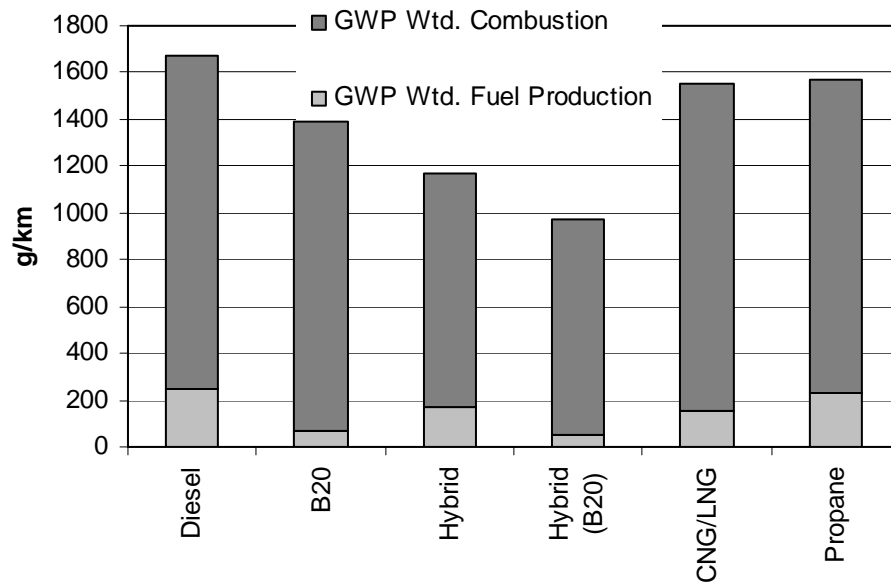


Figure 2. GHG Emissions -- CO₂ Equivalents

4.4 Improved Lubricity

Low-level blends of biodiesel (such as B1 or B2) can improve the lubricity of diesel fuels and may be particularly important for ultra-low sulfur diesel (ULSD) as these fuels can have poor lubricating properties. Engine manufacturers depend on lubricity to keep moving parts (especially fuel pumps) from wearing prematurely. Some fleets choose B2 for its lubricity properties instead of using other additives.

4.5 Safety

Pure biodiesel has a flash point (the temperature at which a fuel ignites) of over 260 °F compared with about 125 °F for regular No. 2 diesel, making biodiesel the safest fuel to store, handle, and use.

4.6 Ease of Use

Blends of B20 or less are basically a “drop in” technology in that no new equipment and no equipment modifications are necessary. B20 can be stored in diesel fuel tanks and can be pumped with diesel equipment. There are, however, several precautions and caveats that must be taken into consideration to ensure trouble-free experience with B20, as discussed in Section 9 of this report.

5. DISADVANTAGES OF BIODIESEL USE

5.1 Reduced Energy Content

Pure biodiesel (B100) contains 8% less energy per gallon than typical No. 2 US diesel and 12.5% less energy per pound (the difference between these two metrics is caused by the fact that biodiesel is slightly more dense than diesel fuel). However, its higher viscosity range (1.9 to 6.0 centistokes) relative to petrodiesel (1.3 to 5.8 centistokes) helps offset the lower energy content through reduced barrel/plunger leakage resulting in slightly improved injection efficiency. Combining lower energy content and slightly improved injection efficiency, biodiesel fuel (B100) provides 5% to 7% less energy per gallon than petrodiesel. Therefore, the reduction in power, torque, and fuel economy is only about 1.2% for B20 and about 0.3% for B5.

5.2 Potential for Increased NO_x Emissions

Although some data (such as that presented in Figure 1) have shown increased NO_x emissions associated with biodiesel combustion, recent studies by the National Renewable Energy Laboratory (NREL) suggest that there is insufficient data to draw any conclusions regarding the average effect of biodiesel on NO_x emissions, even in terms of its directionality.⁵

6. FUEL STANDARDS

All engines are designed and manufactured for a fuel that has certain characteristics. In the US, the industry organization that defines the consensus on fuels is the American Society for Testing and Materials (ASTM). For diesel fuel, the standard is ASTM D 975, and all engine and fuel injection manufacturers design their engines around that standard. In December of 2001, ASTM approved a full standard for biodiesel designated ASTM D 6751. This standard covers pure biodiesel (B100) for blending with petrodiesel in levels up to 20% by volume. Because most of the US experience has been with B20, higher levels of biodiesel are allowed on a case-by-case basis after discussion with the individual engine manufacturer. ASTM is presently working on a B20-specific standard which may be released in mid-2007.

7. EFFECT ON ENGINE DURABILITY AND MAINTENANCE

B20 or lower blends minimize most issues associated with material compatibility. Experience during the past decade with B20 indicates compatibility with all existing elastomers in diesel fuel systems, even those that are sensitive to higher blends such as nitrile rubber. Users should continue to check for leaks, however, and fix them if they occur.

⁵ R. McCormick, *Effect of Biodiesel on NO_x Emissions*, presentation at the ARB Biodiesel Workshop, July 5, 2005, (<http://www.arb.ca.gov/fuels/diesel/altdiesel.htm>).

B20 may degrade faster than petrodiesel if oxidizing metals such as copper, bronze, brass, or zinc are in the fueling systems. If filter clogging occurs more frequently with B20 than with petrodiesel, the fueling system should be checked for these materials and they should be replaced with biodiesel compatible parts.

Although the growing body of long-term experience with B20 in the US will ultimately allow for a more complete assessment of the long-term effects of biodiesel and biodiesel blends on engines and fueling systems, the B20 experience has been positive to date.

8. EFFECT ON ENGINE WARRANTY

Diesel engine companies warranty the product they make (engines) for “materials and workmanship”. If there is a problem with an engine part or with engine operation due to an error in manufacturing or assembly within the prescribed warranty period, the problem will be covered by the engine company. Typically, an engine company will define what fuel the engine was designed to use and will recommend the use of that fuel to their customers in their owner’s manuals.

If engine problems occur and are attributable to a fuel (regardless of whether that fuel is petrodiesel or biodiesel), such problems are not related to the materials or workmanship of the engine and are therefore the responsibility of the fuel supplier, not the engine manufacturer. Any reputable fuel supplier (biodiesel, petrodiesel, or blend of both) should stand behind its products and cover any fuel quality problems should they occur.

Therefore, the issue relating to engine warranties and biodiesel involves whether an engine manufacturer will void its parts and workmanship warranty when biodiesel is used, and whether the fuel producer or marketer will stand behind its fuels should problems occur.

The diesel buses and engines that currently comprise MTD’s fleet, as well as pending bus deliveries, are listed in Table 1.

Table 1. MTD Diesel Bus Fleet

Quantity	Bus	Engine
5	2004 MCI D4000	Detroit Diesel Series 60 Inline 6
15	2004 Gillig LF 40	Detroit Diesel Series 50 Inline 4
11	2004 Gillig LF 30	Cummins ISB02 Inline 6
28	1998 Nova LFS	Detroit Diesel Series 40 Inline 6
5	2000 Nova LFS	Detroit Diesel Series 40 Inline 6
6	1984 Gillig Phantom	Detroit Diesel 6V-92
8	1992 Flxible Metro	2002 ISM Cummins w/ J-M CRT
8 (pending)	2006 Gillig Hybrid	Cummins ISB2006 Inline 6

8.1 Detroit Diesel Position on Biodiesel

Detroit Diesel publishes the following statement regarding the use of biodiesel fuels in their engines:⁶

“Detroit Diesel Corporation highly recommends biodiesel fuels made from soybean or rapeseed oil through the proper transesterification reaction process. Other feedstock source of biodiesel fuels such as animal fat and used cooking oils are not recommended by DDC. Biodiesel fuels meeting ASTM D 6751 specification, prior to blending can be mixed up to 5% maximum by volume in petroleum diesel fuel. The resulting mixture must meet the fuel properties [of] the ASTM D 975 specification. Failures attributed to the use of biodiesel fuel will not be covered by Detroit Diesel product warranty. Also, any engine performance problem related to the use of biodiesel fuel would not be recognized nor considered DDC’s responsibility.”

Although it is understandable and anticipated that Detroit Diesel does not warranty failures and/or problems attributed to the use of biodiesel fuel under their materials and workmanship warranty, the significance of the reference to the use of a 5% maximum biodiesel blend is unclear. A follow-up call was placed to Detroit Diesel and the following clarifications were received:⁷

- Detroit Diesel had previously specified biodiesel blends up to and including B20, but changed to B5 to provide consistency with their competitors (Caterpillar and Cummins);
- Use of B20 does NOT automatically void their product (materials and workmanship) warranty;

⁶ “Engine Requirements – Lubricating Oil, Fuel and Filters”, Section 5.1.4 Biodiesel Fuels, Detroit Diesel Corporation, Rev. 10/05

⁷ Personal communication: Tom Wilterink (Detroit Diesel) and P. Griffith, October 24, 2006

- If a fuel system problem occurs that can be traced to the use of biodiesel, it is covered under warranty at blends up to and including B5 but not at blends greater than B5;

8.2 *Cummins Position on Biodiesel*

Cummins states the following regarding the use of biodiesel fuels in their engines:⁸

“Cummins neither approves or disapproves of the use of biodiesel fuel. Cummins is not in a position to evaluate the many variations of biodiesel fuels or other additives, and their long-term effects on performance, durability or emissions compliance of Cummins products. The use of biodiesel fuel does not affect Cummins Material and Workmanship warranty. Failures caused by the use of biodiesel fuels or other fuel additives are **NOT** defects of workmanship and/or material as supplied by Cummins Inc. and **CANNOT** be compensated under the Cummins’ warranty.

“Bosch states in their Diesel Fuel Quality – Common Position Paper (03/05/99) that no guarantee on FIE (Fuel Injector Equipment) is given so far to any alternative fuel except for Diesel + 5% FAME (Fatty Acid Methyl Esters, i.e., biodiesel derived from soybean or rapeseed oils). There is a major difference between operating on pure (100% concentration) biodiesel and biodiesel/petrodiesel blends.”

Therefore, Cummins specifically states that use of biodiesel does not void its engine warranty and indicates that its fuel injection equipment supplier warrants biodiesel blends of up to B5.

In summary, engine manufacturer warranty coverage is not definitively expressed for a majority of the engines in MTD's bus fleet to operate on B20. Use of B20 at this time could affect warranty coverage of engines and exhaust after-treatment systems. There is some speculation within the industry, however, that both Detroit Diesel and Cummins may specifically allow biodiesel blends of up to B20 after approval and release of the ASTM B20 specification.

9. RECOMMENDATIONS FOR FLEET USE OF B20

The following technical recommendations for B20 fleet use were published in June 2005 by the B20 Fleet Evaluation Team:⁹

⁸ “What is Cummins’ Position on the Use of Biodiesel Fuel in Cummins Engines?”, <http://www.cummins.com/cmi/content.jsp?siteId=1&langId=1033&menuId=6&overviewId=29&anchorId=44&menuIndex=4&index=3#Q6>

⁹ Team members: Cummins, John Deere, International Truck and Engine Corp., DaimlerChrysler, Caterpillar, Ford Motor Company, General Motors, Department of Defense, Siemens, Delphi Automotive Systems, Volkswagen, Engine Manufacturers Association, MARC-IV Consulting, ASG Renaissance, Bosch, FleetGuard, NREL, BMW of North America, Mack Trucks, Stanadyne Automotive Corporation, Suncor, CNH Global, Parker-Hannifin-Racor, and DENSO International America.

- Ensure the biodiesel meets the ASTM specification for pure biodiesel (ASTM D 6751) before blending with petrodiesel. Purchase biodiesel and biodiesel blends only from companies that have been registered under the BQ-9000 fuel quality program.
- Ensure the B20 blend meets properties for ASTM D 975, Standard Specification for Diesel Fuel Oils or the ASTM specification for B20 once it is approved.
- Ensure your B20 supplier provides a homogenous product.
- Avoid long term storage of B20 to prevent degradation. Biodiesel should be used within six months.
- Prior to transitioning to B20, it is recommended that tanks be cleaned and free from sediment and water. Check for water and drain regularly if needed. Monitor for microbial growth and treat with biocides as recommended by the biocide manufacturer. See the NREL Biodiesel Storage and Handling Guidelines for further information <http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/tp36182.pdf>.
- Fuel filters on the vehicles and in the delivery system may need to be changed more frequently upon initial B20 use. Biodiesel and biodiesel blends have excellent cleaning properties. The use of B20 can dissolve sediments in the fuel system and result in the need to change filters more frequently when first using biodiesel until the whole system has been cleaned of the deposits left by the petrodiesel.
- Be aware of B20's cold weather properties and take appropriate precautions. When operating in winter climates, use winter blended diesel fuel. If B20 is to be used in winter months, make sure the B20 cloud point is adequate for the geographical region and time of year the fuel will be used.
- Perform regularly scheduled maintenance as dictated by the engine operation and maintenance manual. If using B20 in seasonal operations where fuel is not used within 6 months, consider storage enhancing additives or flushing with diesel fuel prior to storage.

10. AVAILABILITY AND COST OF BIODIESEL BLENDS

Biodiesel and biodiesel blends are available from a number of BQ-9000 Accredited Producers and Certified Marketers, a comprehensive listing of which is available at http://www.biodiesel.org/buyingbiodiesel/producers_marketers/Supplier_List.pdf.

McCormix Corporation the only retail distributor of biodiesel in Santa Barbara, with B20 available at their Goleta station (Depot Road) and B100 available at both the Goleta station and the Santa Barbara Station (Calle Cesar Chavez). On October 23, 2006, McCormix's retail pump prices were \$2.86/gal for Diesel #2, \$3.24/gal for B20, and \$3.80/gal for B100. The City of Santa Barbara contracts with McCormix for delivery of B20 fuel and reports that bulk pricing ranges from a few cents to ten cents per gallon higher than for Diesel #2.

Although there are a number of BQ-9000 Certified Marketers of biodiesel in California, the only in-state BQ-9000 Accredited Producer is Imperial Western Products (IWP) of

Coachella, CA. Prices fluctuate daily, but on October 24, 2006, IWP's price for B99 was \$1.82/gallon plus ~\$0.15/gallon delivery to Santa Barbara plus ~\$0.52/gallon in taxes (e.g., road tax, excise tax, etc.).¹⁰

MTD currently purchases its ultra-low sulfur diesel fuel from SC Fuels via a Los Angeles MTA-managed cooperative procurement. SC Fuels supplies BQ-9000 soy-derived biodiesel at all blend levels, and reports that B5 and B20 are their two most popular blends. B5 is presently available from SC Fuels at about the same price as petrodiesel, while B20 presently sells at a premium of from two to five cents per gallon.¹¹

Not all blends of biodiesel are available from all suppliers. In some cases, it has been necessary for the end user to blend to the desired level. "Splash blending" is procedure in which biodiesel and diesel fuels are loaded into a vessel separately with relatively little mixing occurring as the fuels are placed in the vessel. The vessel is usually an individual vehicle fuel tank or a fuel delivery truck, although in some cases it could be a drum or a tote. Once the fuels are in the vessel, driving down the road is regarded as sufficient agitation to allow the biodiesel and diesel fuels to become thoroughly mixed. This approach is usually successful but on occasion difficulties in mixing can be encountered if the biodiesel is loaded into the vessel first under very cold temperature conditions (its heavier density and tendency to become more viscous at cold temperatures can result in poor mixing under such conditions). Whenever possible, however, it is preferable to have the blending performed by the fuel supplier.

11. REGULATORY AGENCY POSITION

California Governor's Executive Order S-06-06 sets California biofuels production targets of 20% in 2010, 40% in 2020, and 75% in 2050. State regulatory agencies are therefore under pressure to integrate the use of biodiesel into policy structure.

At the present time, biodiesel blends of B50 to B100 are exempt from California Air Resource Board's (ARB) diesel regulations. Blends greater than B20 and less than B50 are not prohibited by ARB regulations but are not recommended at this time.

On May 24, 2006, the ARB released a "suggested ARB biodiesel policy" which states the following:¹²

- Biodiesel blends can be used in on- and off-road diesel vehicles and engines under the following conditions:
 - i. Biodiesel portion of blend meets ASTM 6751 (15-ppm sulfur);
 - ii. Diesel fuel portion of blend complies with ARB diesel fuel regulations;
 - iii. Resulting mix contains no more than 20% biodiesel by volume.
- Vehicles using ARB-verified retrofit devices can use blends up to B20

¹⁰ Personal communication: Tom Prokop (IWP) and P. Griffith, October 24, 2006

¹¹ Personal communication: Mary Rohrer (SC Fuels) and P. Griffith, November 1, 2006

¹² "Suggested ARB Biodiesel Policy", Presented in the ARB Fuels Workshop, May 24, 2006

- i. Verification based on ARB diesel
- Users should determine if use of the desired biodiesel blend will affect their emission control or engine warranty
 - i. Advised to avoid use of fuel that would negate a warranty

According to ARB staff, the above policy will be formalized soon but does not apply to vehicles subject to in-use fleet regulations.¹³ While fleet regulations are still in development, California Senate Bill 975 (SB975) “allows within California any federal, state, or local agency; any regulated utility, and any owner or operator of solid waste collection vehicles to use biodiesel that contains [up to] 20 percent by volume biodiesel (B20) with retrofit devices . . . whether or not the fuel is verified for use with those retrofit devices.”¹⁴ ARB provides the following written clarifications:

“Two areas of clarification are necessary to deal with the impacts of SB975 on in-use fleet rules: First, fleets will be considered in compliance with in-use fleet rules if they have their vehicles properly equipped with Air Resources Board (ARB)-verified retrofit devices and then use B20 in these vehicles. However, fleet owners and operators should be aware that the voluntary use of B20 in their vehicles with installed retrofit devices prior to the device becoming verified as compatible with B20 nullifies the state's requirement for device manufacturers to carry a warranty of the device. Second, device manufacturers will not be required to include these vehicles as part of the in-use compliance portion of the verification process and will not be responsible for non-performance of their devices on B20.

“Currently, there is one device, the Johnson Matthey CRT™ particulate filter system, verified as compatible with B20 which carries the required warranty protection. ARB staff continues to work with other device manufacturers to prove their systems compatibility with B20.”

In summary, there are no limitations on the use of blends up to B20 in transit fleets with respect to California law (regardless of whether devices are retrofits or OEM fits); the only consideration is whether an operating agency is willing to accept whatever impacts to warranties may arise from use of biodiesel.¹⁵ “Clarifications” (such as that reproduced above) that address the use of biodiesel with retrofit devices (i.e., relating to Senate Bill 975) are NOT intended to limit the use of biodiesel to retrofit buses but rather to clarify warranty requirements pertaining to the use of biodiesel with retrofitted hardware.

Given the fluid and somewhat contradictory nature of state regulations and their interpretations, it is recommended that if MTD elects to proceed with a biodiesel demonstration and evaluation that it submit a letter of intent to ARB and the Santa Barbara APCD prior to implementation.

¹³ Personal communication: Gary Yee (ARB) and P. Griffith, October 26, 2006

¹⁴ Air Resources Board letter from Robert H. Cross (Chief, Mobile Source Control Division) dated December 6, 2005; Mail-Out #MSC 05-21

¹⁵ Personal communication: Kathleen Mead (ARB) and P. Griffith, October 30, 2006

12. TRANSIT BUS FLEET USERS AND PROSPECTIVE USERS

12.1 Cedar Rapids, Iowa

Five Seasons Transportation has been using biodiesel for several years. They began their program with B20 but have since transitioned to B2. Among the reasons for changing to B2 was difficulty managing algae growth at the higher blend level.¹⁶

12.2 Cincinnati, Ohio

Cincinnati Metro began using biodiesel in all four hundred of its transit buses in September 2005 after extensive testing over the past decade.¹⁷ They use B75 except during the winter months when B20 is used to avoid fuel gelling issues. Metro reports that during the summer of 2006 they paid ~\$1.78/gal for B100 (they blend to B20 on site) while petrodiesel prices were ~\$2.30/gal. Metro indicates that their experiences have been positive except for clogged fuel filters when they used biodiesel derived from reclaimed cooking oil rather than soybean oil. They also indicate that frequent replacement of fuel filters may be necessary during the early stages of the program if storage tanks and vehicle tanks are not clean.

Some of Cincinnati Metro's buses are powered by Cummins 2007 engines and Metro reports that Cummins has approved their B75/B20 utilization.

12.3 St. Louis, Missouri

St. Louis Metro experienced positive results during the testing of B25 a couple of years ago and have recently converted one of their garages to B2 use and another to B20, resulting in about half of their buses running on biodiesel.

12.4 King County, WA

King County Metro Transit is using B5 biodiesel (blended with ULSD) in two of its garages and plans to power its entire fleet of more than 1,200 buses with biodiesel by the end of 2006. .

12.5 Knoxville, TN

Knoxville Area Transit (KAT) began using biodiesel blends during the summer of 2004. After running cleaning additives through diesel tanks, B5 was introduced followed by a slow increase to B20. The reclaimed cooking oil / grease-based biodiesel that KAT initially used created some difficulties with filter plugging during cold temperature operation; KAT has since transitioned to soy-based biodiesel and has not experienced any further cold plugging issues.

¹⁶ Personal communication: Dwayne Fosseen (Mirencos Fuel) and P. Griffith, October 25, 2006

¹⁷ Personal communication: Don Devore (Maintenance Manager, Cincinnati Metro), Ken Lovelow (Fuel Manager) and P. Griffith, October 25, 2006

12.6 San Francisco, CA

San Francisco Muni has been considering the use of biodiesel for some time but has elected to not integrate the fuel into its bus fleet until such time that engine manufacturers specifically approve the use of B20.¹⁸

13. SANTA BARBARA COUNTY FLEET USERS AND PROSPECTIVE USERS

13.1 City of Santa Barbara

In 2004, the City of Santa Barbara began testing the use of B20 in three of their fleet vehicles (during the test phase the three vehicles were filled at McCormix filling station in Goleta). Although they experienced one incident of substandard fuel early in the test program that resulted in plugged fuel filters, they encountered no other problems or concerns. As a result, on July 1, 2006, the City began using B20 to fuel their entire diesel-powered fleet of approximately 150 vehicles (street sweepers, fire trucks, beach-cleaning tractors, and other large vehicles in nearly every city department). At the time of this report, they have not experienced any problems during the initial four months of operation with B20.¹⁹

City staff advises that it is crucial that a quality biodiesel fuel supplier be utilized and recommends that a 10-micron fuel filter be installed on the dispenser.

13.2 County of Santa Barbara

The County of Santa Barbara has been “teetering on the fence” regarding the possible adoption of B20. Considerations that have delayed the transition include:²⁰

- Increased NO_x emissions according to some studies;
- Single fuel storage tank at County means that all diesel-powered equipment would have to convert to B20, and their backup generators are sensitive to the microbial growth that is possible with biodiesel blends;
- Lack of a strong endorsement from the Santa Barbara APCD;
- Lack of pressure to make the change.

¹⁸ Personal communication: Elson Hao (San Francisco Muni) and P. Griffith, October 27, 2006

¹⁹ Personal communication: Gary Horwald (Fleet Supervisor, City of Santa Barbara) and P. Griffith, October 23, 2006

²⁰ Personal communication: Mitch Guenthart (Maintenance Manager, County of Santa Barbara) and P. Griffith, October 23, 2006